THE NORTH AMERICAN SPECIES OF THE BEE GENUS *LITHURGE* (HYMENOPTERA: MEGACHILIDAE)

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ABSTRACT. The North American species of *Lithurge* are reviewed, and a key is given for the separation of both sexes of all species. Supraclypeal structures of the females are illustrated, as are the labral structures of the males. Of the previously described native forms, *L. apicalis* var. *opuntiae* Cockerell and *L. arizonensis* Cockerell are synonyms of *L. apicalis* Cresson (NEW SYNONYMY); *L. apicalis* subsp. *littoralis* Cockerell is a valid species and a senior synonym of *L. bruesi* Mitchell (NEW SYNONYMY). One new species, *L. listrota,* is deseribed from southern California desert regions. All native American species belong to the subgenus *Lithurgopsis.*

Two representatives of the nominate subgenus occur in the New World. The Palaearctic species, *L. chrysurus* (Fonscolombe), is adventive in the eastern United States. A South American species, *L. huberi* Ducke, belongs to the Indo-Australian species group of *L. atratus* F. Smith and may have been introduced into Brazil in historic times.

The South American genera *Trichothurgus* Moure and *Lithurgomma* Moure are merged into a single genus, *Trichothurgus,* and the tribe Trichothurgini is dropped.

INTRODUCTION

The megachilid subfamily Lithurginae includes about 50 speeies in both Old and New World faunas. Old World species all belong to the nominate subgenus of *Lithurge* Latreille and are present in the southern Palaearctic, Ethiopian and Indo-Australian regions. These species, as far as known, provision their nests with pollen from plants of the families Malvaceae and Compositae.

For the most part, New World species of *Lithurge* belong to the subgenus *Lithurgopsis* Fox and are present in southern North America and South America. One Palaearctic species, *L. chrysurus* (Fonscolombe), is adventive in the eastern United States (Roberts, 1978); a Brazilian species, *L. huberi* Ducke, also belongs to the nominate subgenus and is probably introduced from the Indo-Australian region. Although most *Lithurgopsis* utilize pollen from Cactaceae in their larval cells, a few Argentinian species use malvaceous pollens (J. L. Neff, in litt.). Some Chilean and Argentinian species, formerly placed in *Lithurge,* are now placed in the genera *Trichothurgus* and *Lithurgomma,* both described by Moure (1949); at least one of these is an oligolege on Compositae (J. L. Neff, in litt.).

THE NEW WORLD LITHURGINAE

Most New World Lithurginae have been described in the genus *Lithurgus* Berthold, 1827, an invalid emendation of *Lithurge* Latreille, 1825. Fox (1902) noted that males of the New World species possess tarsal arolia and proposed to remove them to a new genus, *Lithurgopsis.* Subsequent workers have consistently treated *Lithurgopsis* as a subgenus of *Lithurge* (e.g., Michener, 1944; Hurd, 1979).

In addition to the presence of tarsal arolia in *Lithurgopsis* males, there are other features by which members of the subgenus may be separated from the nominotypical subgenus. In females of *Lithurgopsis* the facial prominence, when present, occurs only on the supraclypeal area; in *Lithurge, sensu stricto,* the basal portion of the clypeus is also involved. The first flagellar segment is consistently short in both sexes of *Lithurgopsis*; it is little, if any, longer than the second and often much shorter; the second segment is as long as broad or longer. In *Lithurge, sensu stricto,* the first flagellar segment is as long as broad, or longer, the second segment not more than half as long as the first; the second segment is often conspicuously broader than long.

Lithurge (*L.*) *chrysurus* (Fonscolombe, 1834) is a Palaearctic species that is now introduced and established in the eastern United States. Roberts (1978) reported this Mediterranean species from New Jersey, discussed its nesting biology and behavior, and described the larva and pupa.

Lithurge (*L.*) *huberi* (Ducke, 1907), described from Brazil, is the only South American representative of the nominotypical subgenus. I have seen specimens of both sexes of this species. Morphologically, *L. huberi* is a member of the group of forms related to *L. atratus* (F. Smith). Nominate species of this group range from India to Australia, Melanesia, and Polynesia; according to Michener (1965) there may be but a

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single species involved. There are no obvious morphological features by which *L. huberi* may be separated from *L. atratus*. It seems likely that *L. huberi* is adventive in Brazil, introduced via infested wood within historic times.

Although most New World Lithurginae belong to the genus *Lithurge*, Moure (1949) described two genera, *Trichothurgus* and *Lithurgomma*, which he placed in the new tribe Trichothurgini. Species of Trichothurgini occur in Peru and Argentina but are primarily Chilean. *Trichothurgus* and *Lithurgomma* differ from *Lithurge* in the elongate labrum and in the shape of the first gastric tergum, which is not flattened as in *Lithurge*. The species of these two genera are large, robust bees with abundant body hairs that conceal most integumentary surfaces.

In *Trichothurgus*, the facial prominence, if present, is on the supraclypeal area and the frons lacks a shiny area in front of the anterior ocellus. Species of *Lithurgomma* have a clypeal prominence, in females only, and there is a large, flattened, shiny area in front of the anterior ocellus. These differences are trivial and do not, in my opinion, justify the status of *Trichothurgus* and *Lithurgomma* as separate genera. My view is that *Lithurgomma* is a junior synonym of *Trichothurgus* (NEW SYNONYMY). The characters of Moure's Trichothurgini will differentiate the expanded genus *Trichothurgus* from *Lithurge*. Concurrently, the tribe Trichothurgini is superfluous; there is no need to place the two genera of Lithurginae in separate tribes.

The known species of *Trichothurgus* are: *T. albiceps* (Friese), *T. alpestris* (Friese), *T. aterrimus* (Cockerell), *T. colloncurensis* Ogloblin, *T. herbsti* (Friese), *T. holomelan* (Moure), *T. laticeps* (Friese), *T. neoqueensis* (Friese), *T. osmioides* (Friese), *T. pseudocellatus* (Moure), *T. shajovskoyi* Ogloblin, and *T. wagenknechti* (Moure).

The few South American species of *Lithurge* have never been critically examined. The North American species were reviewed by Mitchell (1938), who gave a key for the species then known. The biology of no American species has been studied in detail; some notes on *L. apicalis* (Cresson) were published by Parker and Potter (1973), and Brach (1979) reported some observations on *L. gibbosa* (F. Smith). The nesting biology and behavior of the introduced species, *L. chrysurus*, were described by Roberts (1978).

SPECIMENS EXAMINED

During the course of this study, specimens from the following institutional collections were examined: American Museum of Natural History (AMNH), Arizona State University (ARSU), British Museum (Natural History) (BMNH), California Academy of Sciences (CAS), California Department of Food and Agriculture (CDFA), National Museum of Natural History (USNM), Natural History Museum of Los Angeles County (LACM), San Diego Natural History Museum (SDM), Texas A and I University (TAI), Texas A and M University (TAMU), University of Arizona (UNAR), University of California, Berkeley (UCB), University of California, Davis (UCD), University of California, Riverside (UCR), University of Colorado (UCOL), University of Kansas (UKAN), University of Nebraska (UNEB), and Utah State University (UTSU). Specimens from the personal collection of T. Griswold are indicated (GRIS).

SYSTEMATICS

In the review by Mitchell (1938), five species were treated in the North American fauna, one with three subspecies. A sixth species was mentioned but not treated as it had been too recently described and was unknown to Mitchell. The present study recognizes eight species, including one adventive species and one that was previously undescribed. The various subspecies attributed to *L. apicalis* by Mitchell (1938) are discussed below. The morphological characteristics of each species are sufficiently distinctive that the previously described species are not redescribed; the keys and figures given here are adequate for their recognition.

Superficially, the various species tend to be quite similar. Females are most notably different from one another in the shape of the elevations or processes of the supraclypeal area. There are differences, also, in the density of the punctures of the clypeus and supraclypeal area, but there is sufficient infraspecific variability to render these unreliable as diagnostic characters.

Males are most readily separated by differences in labral structure. When fresh, individuals of this sex should have the mandibles spread so that the external surface of the labrum is clearly visible. Although the mandibles of a dry specimen can be spread after relaxing the bee, there is a greater chance that the specimen will be damaged.

KEY TO NORTH AMERICAN *LITHURGE*

Males

1a. Tarsal arolia present; first flagellar segment shorter than second (subgenus *Lithurgopsis*) 2
b. Tarsal arolia absent; first flagellar segment distinctly longer than second (subgenus *Lithurge*) .... *chrysurus* (Fonscolombe)

2a. Labrum with a single median tubercle, or none 3
b. Labrum with a pair of erect, slender tubercles (Fig. 4) ..... *littoralis* (Cockerell)

3a. Labrum without median tubercle, with a low, transverse basal ridge or swelling (Figs. 6, 10) 4
b. Labrum with an erect, median tubercle, without transverse basal ridge or swelling (Figs. 8, 12) 6

4a. Supraclypeal area gently convex, its upper portion sloping toward antennal sockets, and with a definite median area that is less closely punctate than area near subantennal suture or entire supraclypeal area sparsely and irregularly punctate 5
b. Supraclypeal area uniformly flat between clypeal base and antennal sockets, continguously punctate, punctures coarse and subcontiguous along midline .... *planifrons* (Friese)

5a. First flagellar segment, on shortest side, distinctly broader than long, shorter than pedicel; supraclypeal area about

1.4 times wider than long; legs usually reddish ..... *echinocacti* (Cockerell)

b. First flagellar segment, on shortest side, about as long as wide, about as long as pedicel; supraclypeal area about 1.8 times wider than long; legs brown ..... *apicalis* (Cresson)

6a. Labrum with a low, often obsolescent, ridge extending obliquely from basal corner to base of median tubercle (Figs. 2, 12) 7

b. Labrum deeply concave on either side of tubercle and with a short, curved ridge from base of tubercle to mid-length of lateral margin (Fig. 8) ..... *socorroensis* (Mitchell)

7a. Supraclypeal area slightly protuberant, densely punctate; ocelloccipital distance greater than interocellar distance ..... *gibbosa* (F. Smith)

b. Supraclypeal area flat, sparsely punctate, at least in middle; ocelloccipital distance less than interocellar distance ..... *listrota* new species

Females

1a. First flagellar segment shorter than second; facial prominence, when present, not as below (subgenus *Lithurgopsis*) 2

b. First flagellar segment distinctly longer than second; facial prominence high, triangular in lateral view, its lower portion sloping toward base of clypeus (subgenus *Lithurge*) ..... *chrysurus* (Fonscolombe)

2a. Supraclypeal protuberance nearly as broad as face, extending laterad of subantennal sutures (Figs. 3, 5); malar area distinct and with deep posterior pit (Figs. 3, 5) .. 3

b. Supraclypeal protuberance, when present, much narrower than width of face, not extending laterad of subantennal sutures (Figs. 7, 9, 11); malar area linear, mandible nearly contiguous with eye, posterior pit usually absent (Figs. 1, 7, 9) 4

3a. Labral tubercle with median and sublateral impressions; clypeus without preapical ridge (Fig. 3) ..... *littoralis* (Cockerell)

b. Labral tubercle divided in middle only (Fig. 5); clypeus with preapical ridge which is interrupted in middle (Fig. 5) ..... *apicalis* (Cresson)

4a. Supraclypeal area distinctly elevated on each side of middle or with a single, transverse, bowed elevation ... 5

b. Supraclypeal area flat, with no protuberance, shiny and very sparsely punctate (Fig. 1) ... *listrota* new species

5a. Supraclypeal area with prominent rounded elevation on either side of middle (Figs. 7, 9); malar area without posterior pit 6

b. Supraclypeal elevation a high, transverse, bowed ridge (Fig. 11); malar area with broad, shallow, posterior pit ..... *gibbosa* (F. Smith)

6a. Dorsal margin of pronotum with conspicuous fascia of dense, plumose, white hairs; ocelloecipital distance less than interocellar distance ..... *echinocacti* (Cockerell)

b. Dorsal margin of pronotum without fascia of dense, plumose, white hairs; ocelloccipital distance greater than interocellar distance ..... *socorroensis* (Mitchell)

Lithurge (*Lithurgopsis*) *apicalis* (Cresson)

Figures 5, 6

Lithurgus apicalis Cresson, 1875:724. ♀.

Lithurgopsis apicalis var. *opuntiae* Cockerell, 1902:182. ♀. NEW SYNONYMY.

Lithurgus arizonensis Cockerell, 1937:108. ♀. NEW SYNONYMY.

RANGE

South Dakota and Wyoming to western Texas (?), west to Utah, Nevada, and southern California; northern Mexico.

Although this species has been recorded from Texas by previous authors (Cockerell, 1911; Mitchell, 1938), I have seen no material of *L. apicalis* from that State. All specimens from Texas previously identified as *L. apicalis*, that I have examined, proved to be *L. littoralis*.

BIONOMICS

Parker and Potter (1973) published some notes on the nesting habits of *L. apicalis*. The larva has been described by Rozen (1973).

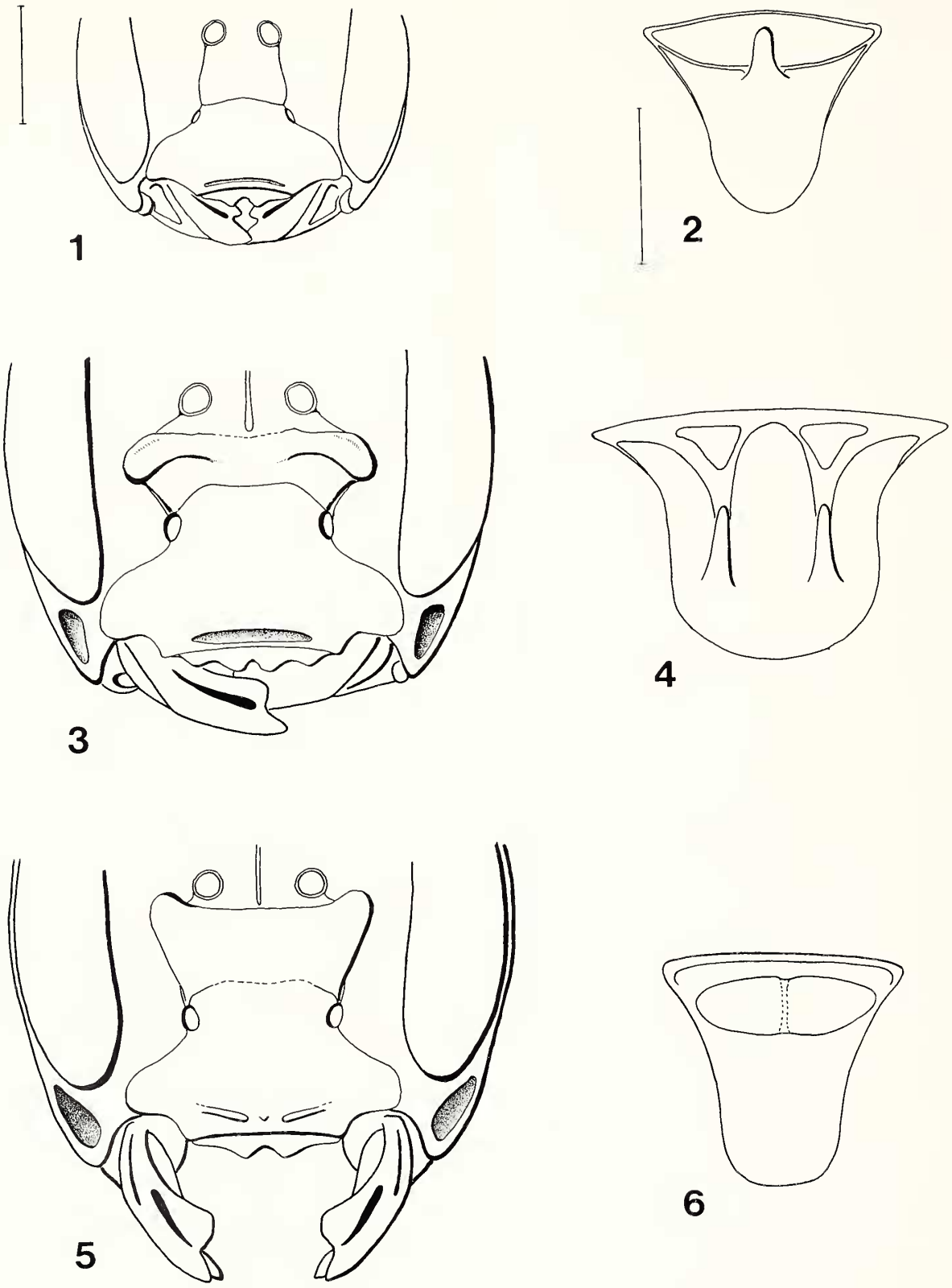
Females provision the cells with pollen from species of *Opuntia*, but both sexes have been taken at flowers of other genera. Hurd (1979) recorded this species on flowers of *Echinocactus, Encelia californica, Eriogonum*, and *Sphaeralcea*. Previously unpublished floral records include: *Agave nevadensis, Argemone platyceros, Argemone* sp., *Asclepias erosa, Baileya multiradiata, Cirsium californicum, Cirsium* sp., *Calochortus concolor, Chilopsis linearis, Cleome serrulata, Cnicus* sp., *Grindelia squarrosa, Prosopis juliflora, Robinia neomexicana, Senecio longilobus, Verbena stricta, Verbesina encelioides*, and "sweet pea."

DISCUSSION

For many years, *L. apicalis* has been divided into two subspecies: *L. a. apicalis* and *L. a. opuntiae*. The former, with ferruginous hairs on the last tergum of the female, is a northern form, found in South Dakota, Wyoming, Nebraska, Kansas, Colorado, Utah, and Nevada. The southern population, *L. a. opuntiae*, with dark brown hairs on the last tergum of the female, ranges from New Mexico to southern California. Both forms, however, occur in New Mexico, Arizona, and California. In many areas the two occur together, along with many specimens of intermediate character.

In view of the broad zone of intergradation, were mixing of the forms occurs and which actually includes much of the range of *L. a. opuntiae*, it hardly seems desirable to separate the two forms nomenclatorially. Accordingly, *L. a. opuntiae* its here treated as a synonym of *L. apicalis*.

Cockerell (1937) described *L. arizonensis* from two females collected in the Baboquivari Mountains of Arizona. These were said to differ from *L. a. opuntiae* by their more



Figures 1–6. *Lithurge* spp. **Figs. 1, 3, 5,** lower portion of face of female of *L. listrota* (1), *L. littoralis* (3), and *L. apicalis* (5). Scale line = 1.0 mm. **Figs. 2, 4, 6,** labrum of male of *L. listrota* (2), *L. littoralis* (4), and *L. apicalis* (6). Scale line = 0.5 mm.

flattened and coarsely punctate clypeus and by the deeper, sparser facial punctures. I have examined the type of *L. arizonensis* (in the CAS) and find no significant differences between this specimen and other individuals of *L. apicalis*. All the differences cited by Cockerell fall well within the range of character variation that I attribute to this species.

The male from Port Isabel, Texas, described by Cockerell (1917) as *L. apicalis* subsp. *littoralis,* is a distinct species and a senior synonym of *L. bruesi* (see below).

TYPE MATERIAL

Lithurgus apicalis Cresson: female, in Academy of Natural Sciences, Philadelphia. *Lithurgopsis apicalis* var. *opuntiae* Cockerell: no types designated, and none of the original material can be identified with surety. *Lithurgus arizonensis* Cockerell: female, in California Academy of Sciences, San Francisco.

SPECIMENS EXAMINED (566 ♀♀, 423 ♂♂)

UNITED STATES. ARIZONA, *Apache Co.:* White Mts. (CAS); Carrizo (UNAR). *Cochise Co.:* Chiricahua Mts. (Barfoot Park, 8600 ft. elev.; Cave Creek; Pinery Canyon; Portal and vicinity; Southwest Research Station; Sunny Flat; AMNH, ARSU, LACM, UNAR, UCB, UCD, UKAN, UTSU); Huachuca Mts. (Ramsey Canyon; UKAN, UNAR); Mustang Mts. (UKAN); 6 mi. SE of Willcox (AMNH); Douglas (UCB). *Coconino Co.:* 24 mi. W of Cameron (UKAN, UNEB); Fredonia (UTSU); Grand Canyon Natl. Park (LACM, UCD, UNAR); Flagstaff and vicinity (UCB, UNAR, USNM); Oak Creek Canyon (CAS, LACM, UKAN, UNEB, UTSU); Sedona (UKAN, UNAR). *Gila Co.:* Florence (ARSU); 18 mi. SE of Globe (UKAN); 18 mi. S of Payson (UNAR); San Carlos Lake (UNAR). *Greenlee Co.:* 23 mi. N of Clifton (ARSU). *Maricopa Co.:* Granite Reef Dam (ARSU). *Navajo Co.:* Fort Apache (UNAR); Cedar Creek, 15 mi. W of Fort Apache (UNAR); 16 mi. SW of Kayenta (ARSU); Marsh Pass (USNM, UTSU). *Pima Co.:* Baboquivari Mts. (Brown Canyon; Elkhorn Ranch Canyon; AMNH, CAS, LACM, UKAN, UNAR); Redington and Redington Pass (UNAR); Rincon Mts. (Madrona Ranger Station; 1.5 mi. NE of X-9 Ranch; UNAR); Santa Rita Mts. (Gardner Canyon; Madera Canyon; LACM, UKAN, UNAR); Santa Catalina Mts. (Sabino Canyon; UNAR); Silver Bell bajada (LACM); Tucson and vicinity (UCD, UNAR, UNEB, USNM, UTSU). *Pinal Co.:* Oracle (USNM); Superior (B. Thompson Arboretum; UNAR). *Santa Cruz Co.:* Atascosa Mts. (Sycamore Canyon; UNAR); Nogales (USNM); Patagonia (UNAR); Sonoita (LACM). *Yavapai Co.:* Ash Fork (USNM); Hell Canyon (ARSU); Jerome and vicinity (UKAN, UNEB); Mingus Mt. (UTSU); 5 mi. NE of Paulden (ARSU); Prescott and vicinity (LACM, UCB); 24 mi. SE of Wikieup (ARSU). *County unknown:* White River (UNAR; this locality name occurs in three different counties). CALIFORNIA, *Inyo Co.:* Bristlecone Natl. Forest (Schulman Grove; UCD, UTSU); Argus Mts. (LACM); Mountain Spring (UCB); Panamint Mts. (Bennett Peak, 9980 ft. elev.; Frenchman's Canyon, 6800–7200 ft. elev.; GRIS, UCR, UTSU); White Mts. (Wyman Canyon, 8500 ft. elev.; UCB). *Los Angeles Co.:* Eagle Rock (UKAN). *Mono Co.:* Benton (UCD); Cottonwood Creek (9300 ft. elev.; UCB); Mammoth Lake (UCD, UTSU). *Riverside Co.:* Anza and vicinity (CDFA, LACM, UCB, UCD, UTSU); Banning (CAS); Deep Canyon (UCB, UCR); Joshua Tree Natl. Monument (UCR); Mt. San Jacinto (UTSU); 4 mi. S of Palm Desert (UCB); Palm Springs (UCD); Piñon Flat (LACM, UCB, UKAN); Ribbonwood (UCB); Santa Rosa Peak (8000 ft. elev.; CAS). *San Bernardino Co.:* Caruthers Canyon (5650 ft. elev.; GRIS); Cedar Canyon (5100 ft. elev.; GRIS); 9.5 mi. NNE of Cima (4200–4265 ft. elev.; LACM); Cima Dome (5050 ft. elev.; GRIS); Clark Mtn. (6000 ft. elev.; GRIS); Deep Creek Public Camp (LACM); Dove Spring (4600 ft. elev.; GRIS); Falls Public Camp (UCB); Forest Home (CAS, UCR); Granite Mts. (4050 ft. elev., GRIS); Joshua Tree (LACM); Lower Covington Flat (LACM); Mitchell's Caverns (GRIS); s. fork, Santa Ana River (UNEB); Wheaton Springs (UCB). *San Diego Co.:* Anza-Borrego Desert State Park (LACM); 5 mi. W of Borrego Springs (UCD); Jacumba (LACM); 10–11 mi. E of Julian (LACM); Laguna (SDM); Mt. Laguna (UCB); Oak Grove (UCR); San Felipe Wash (LACM, UCR); 2 mi. N of Warner Springs (LACM, UCB, UCD, UTSU). COLORADO, *Alamosa Co.:* Great Sand Dunes Natl. Monument (LACM, UCOL, UKAN). *Archuleta Co.:* Arboles (USNM); Yellow Jacket (UCOL). *Boulder Co.:* Boulder and vicinity (AMNH, UCOL, UKAN); Gregory Canyon (AMNH); Pinecliffe (UKAN). *Chaffee Co.:* Bucna Vista (7900–8000 ft. elev.; AMNH). *Costilla Co.:* Fort Garland (UNEB). *Crowley Co.:* Fowler (UCOL). *Delta Co.:* 5 mi. N of Cedaredge (UCOL); Delta (UCOL); Paonia (CAS). *El Paso Co.:* Manitou (UCB, UKAN, USNM); Ute Creek (UNEB). *Fremont Co.:* Cañon City (UKAN); 10 mi. NE of Cotopaxi (5900 ft. elev.; UKAN). *Garfield Co.:* Glenwood Springs (AMNH). *Huerfano Co.:* Cuchara Dam (UCOL); Lathrop State Park (UCOL); 2–3 mi. W of Walsenberg (UCOL, UKAN). *Mesa Co.:* Colorado Natl. Monument (UCOL). *Moffat Co.:* Dinosaur Natl. Monument (Castle Rock; Red Rock Ranch; UCOL). *Montrose Co.:* Naturita (UKAN). *Ouray Co.:* Ridgway (AMNH). KANSAS, *Hamilton Co.:* (UKAN). *Kingman Co.:* Calista (UKAN). *Pratt Co.:* 8 mi. NE of Isabel (UKAN). NEBRASKA, *Arthur Co.:* 4 mi. N of Arthur (UKAN). *Sioux Co.:* Warbonnet Canyon (UNEB). NEVADA, *Clark Co.:* (SDM); Charleston Mts. (Lee Canyon; Willow Creek Camp; AMNH, UCD). *Humboldt Co.:* Winnemucca (UTSU). NEW MEXICO, *Bernalillo Co.:* Cedro Canyon (UKAN); Cienega Canyon (UKAN); Sandia Mts. (UKAN). *Chavez Co.:* Elk (UNAR). *Dona Ana Co.:* Las Cruces (AMNH, BMNH, UCOL, UKAN, UTSU). *Grant Co.:* 13 mi. N of Silver City (6900 ft. elev.; AMNH). *Guadalupe Co.:* Vaughn (UNEB). *Hidalgo Co.:* Post Office Canyon (ARSU). *Lincoln Co.:* Alto (UKAN); Capitan (UNEB); Lincoln (UKAN); Nogal (UKAN, UNEB); Ruidoso and vicinity (AMNH, UKAN). *McKinley Co.:* Pinedale (USNM). *Otero Co.:* High Rolls (AMNH). *Rio Arriba Co.:* Ghost Ranch (UNAR); Echo Canyon (UCR). *Sandoval Co.:* Jemez Spring (AMNH); 10 mi. N of Jemez Spring (7500 ft. elev.; AMNH); San Ysidro (AMNH). *San Juan Co.:* Bloomfield (UTSU). *Santa Fe Co.:* Lamy (USNM); Nambe (UTSU); Santa Fe and vicinity (CAS, UKAN, UNEB). *Torrance Co.:* Durran

(UCB). OKLAHOMA, *Custer Co.:* Weatherford (UKAN). *Cimarron Co.:* Black Mesa (UTSU). SOUTH DAKOTA, *Custer Co.:* Custer (UNEB). UTAH, *Beaver Co.:* Beaver (UTSU); 16 mi. E of Beaver (Keat's Lake, 8800 ft. elev.; AMNH). *Cache Co.:* Logan (UCD). *Duchesne Co.:* Roosevelt (UTSU). *Garfield Co.:* Escalante River (UTSU). *Grand Co.:* Castle Valley (UTSU). *Juab Co.:* Eureka (UTSU). *Kane Co.:* Kanab (UTSU); Navajo Mt. (UTSU). *San Juan Co.:* 5 mi. W of Monticello (Dalton Springs, 850 ft. elev.; AMNH). *Tooele Co.:* (UCD). *Uintah Co.:* Vernal (UTSU). *Utah Co.:* Thistle (UTSU). WYOMING, *Albany Co.:* Laramie and vicinity (UKAN, UTSU). *Sweetwater Co.:* Green River (AMNH). *Weston Co.:* Newcastle (USNM). *MÉXICO.* BAJA CALIFORNIA: Cañon del Tajo (LACM); 3 mi. S of Encinas (UCB) SONORA: San Bernardo (LACM).

Lithurge (*Lithurgopsis*) *echinocacti* (Cockerell)

Figures 9, 10

Lithurgus echinocacti Cockerell, 1898:453. ♀.

RANGE

New Mexico to southern California; northwestern México, south to Nayarit.

BIONOMICS

In Arizona, *L. echinocacti* has been observed nesting in rotted wood (Parker and Potter, 1973). Females collected near Sahuarita, Pima County, Arizona, are noted to have been "boring in post attached to house."

Known pollen sources for females are various species of *Echinocactus.* Other floral records for this bee include *Argemone* sp., *Baccharis* sp., *Baileya pleniradiata, Chilopsis linearis, Ferocactus wislizeni, Heterotheca* sp., *Parkinsonia aculeata,* and *Tamarix pentandra.*

DISCUSSION

This appears to be an uncommon species. Females may be easily recognized by the combination of two conical protuberances on the supraclypeal area, the presence of a pubescent fascia on the dorsal margin of the pronotum, and the usually red legs. Males are similar to those of *L. apicalis* in that both lack labral tubercles, but differ in the narrower supraclypeal area.

TYPE MATERIAL

Lithurgus echinocacti Cockerell: female, present location unknown.

SPECIMENS EXAMINED (38 ♀♀, 97 ♂♂)

UNITED STATES. ARIZONA, *Cochise Co.:* Apache Pass (LACM); 12 mi. E of Benson (Texas Canyon, 4800 ft. elev.; LACM); Portal and vicinity (LACM, UCB, UCR). *Graham Co.:* Dripping Spring, Whitlock Mts. (UNAR). *Pima Co.:* Florida Wash (SDM); Santa Rita Mts. (Box Canyon; Madera Canyon; IBP site; AMNH, LACM, UCD, UNAR, UTSU); Silver Bell bajada (LACM); Mountain View (LACM, UCR); Santa Catalina Mts. (Sabino Canyon; Peppersauce Canyon; AMNH, UCR, UNAR); Continental (UCR, USNM); Baboquivari Mts. (Brown Canyon; Kitts Peak; AMNH, UKAN, UNAR); Sahuarita (UNAR); Tucson and vicinity (AMNH, CAS, UCB, UKAN, UNAR, UTSU). *Pinal Co.:* Oracle and vicinity (CAS, LACM, UCR); Ray (ARSU); Superior (B. Thompson Arboretum; UNAR). *Santa Cruz Co.:* 20 mi. N of Nogales (Tumacacori; UNAR); Peña Blanca (UCD). CALIFORNIA, *Inyo Co.:* 5 mi. E of Valley Wells (UCR). NEW MEXICO, *Hidalgo Co.:* 19 mi. N of Rodeo (UTSU). *MÉXICO.* BAJA CALIFORNIA: 13 mi. SE of Millers Landing (ARSU); 11 mi. E of Rosalillito (UNAR); 13 km. NW of Rosarito (LACM); Valle de Santa Maria (LACM). BAJA CALFORNIA SUR: 48 km. S of Loreto (LACM); Los Barriles (CDFA). NAYARIT: 43 mi. N of Tepic (UCB). SONORA: Guaymas (UTSU); Río Mayo (UTSU); San Bernardo (LACM).

Lithurge (*Lithurgopsis*) *gibbosa* (F. Smith)

Figures 11, 12, 13

Lithurgus gibbosus F. Smith, 1853:147. ♀.
Lithurgus compressus F. Smith, 1853:147. ♂.

RANGE

North Carolina to Florida, west to Kansas, Oklahoma, and Texas.

BIONOMICS

Notes on the nesting biology of *L. gibbosa* were published by Brach (1979). Females provision cells with pollen from species of *Opuntia.* Mitchell (1962) has recorded this bee from flowers of the genera *Cirsium, Helianthus, Ilex, Pontaderia,* and *Rudbeckia.* I have also seen a few males taken at *Centaurea americana, Ratibida* sp., and *Teucrium* sp. in Texas.

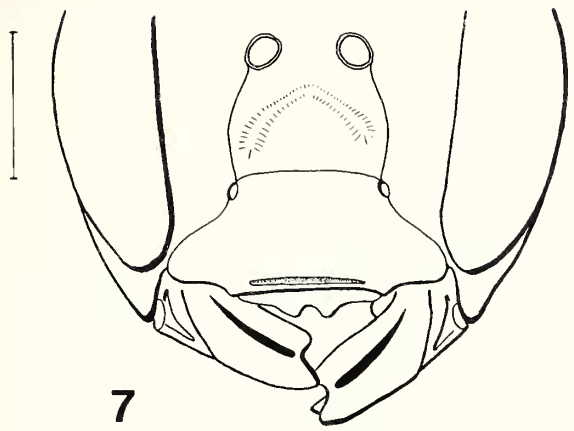
DISCUSSION

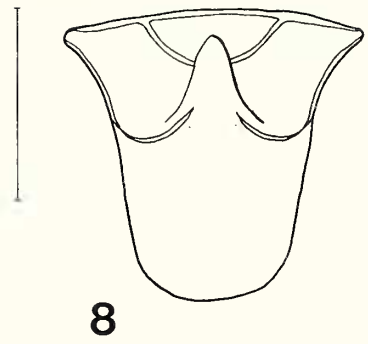
The female of *L. gibbosa* is easily recognized by the high, bowed supraclypeal process, similar to that of members of the Palaearctic species allied to *L. cornuta* (Fabricius).

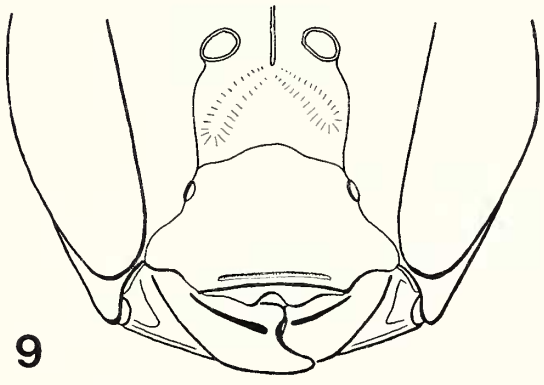
Males are recognizable by the combination of densely punctate supraclypeal area, the presence of a single labral tubercle, and the long ocelloccipital distance. The labral tubercle is a curved, transverse, subapical ridge; in the center, this ridge is elevated. Males from Florida and Georgia have this median elevation abrupt and quite prominent (Fig. 12). The median elevation in males from Texas is less pronounced (Fig. 13). This difference between specimens from the two areas is consistent but does not correlate with other features.

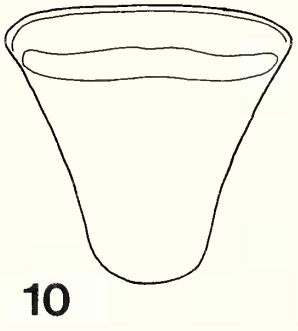
TYPE MATERIAL

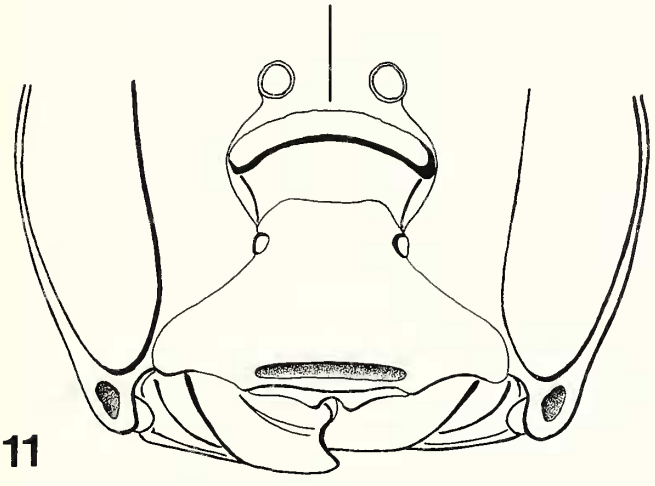
Lithurgus gibbosus F. Smith: females, British Museum (Nat-

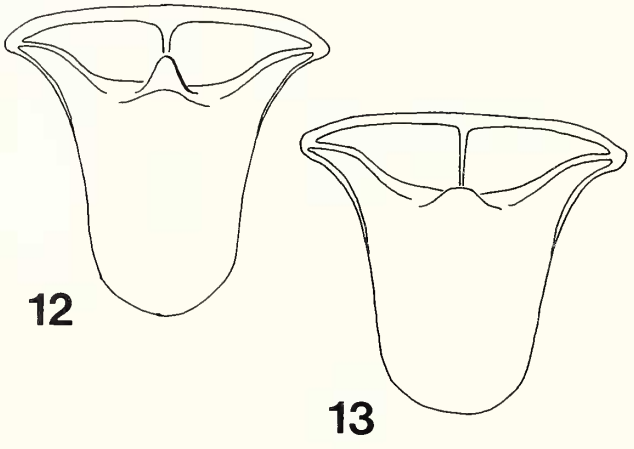












Figures 7–13. *Lithurge* spp. **Figs. 7, 9, 11,** lower portion of face of female of *L. socorroensis* (7), *L. echinocacti* (9), and *L. gibbosa* (11). Scale line = 1.0 mm. **Figs. 8, 10, 12, 13,** labrum of male of *L. socorroensis* (8), *L. echinocacti* (10), and *L. gibbosa* from Florida and Texas (12 and 13, respectively). Scale line = 0.5 mm.

ural History). *Lithurgus compressus* F. Smith: male, British Museum (Natural History).

SPECIMENS EXAMINED (123 ♀♀, 98 ♂♂)

UNITED STATES (western records only). KANSAS, *Kingman Co.:* Calista (UKAN). OKLAHOMA, *Caddo Co.:* Red Rock Canyon State Park (UKAN). TEXAS, *Angelina Co.:* 10 mi. N of Lufkin (AMNH). *Bastrop Co.:* Bastrop and vicinity (UKAN, TAMU); McDade (UKAN). *Bexar Co.:* (TAMU, UTSU); San Antonio (USNM). *Brazos Co.:* (TAMU, UCB); College Station (TAMU). *Crockett Co.:* (TAMU). *De Witt Co.:* Cuero (AMNH). *Gillespie Co.:* Fredricksburg (USNM). *Goliad Co.:* (TAMU). *Gonzales Co.:* Palmetto State Park (UCB). *Howard Co.:* Big Spring (USNM). *Jackson Co.:* Edna (UKAN). *Kerr Co.:* Kerrville (USNM). *La Salle Co.:* Cotulla (USNM). *Lee Co.:* Fedor (AMNH, USNM); Giddings (UKAN). *Matagorda Co.:* Matagorda (UKAN). *Maverick Co.:* (AMNH). *Robertson Co.:* (TAMU). *Shackleford Co.:* 3 mi. S of Throckmorton (UKAN). *Torrant Co.:* Fort Worth (TAMU). *Zavalla Co.:* Nueces River (USNM).

Lithurge (*Lithurgopsis*) *listrota,* new species

Figures 1, 2

DIAGNOSIS

Both sexes are separable from all previously described *Lithurgopsis* by the flat supraclypeal area with a shiny impunctate median line that extends onto the clypeus; the male is further distinguished from *L. planifrons,* the only other flat-faced species, by possessing a labral tubercle.

DESCRIPTION

FEMALE. Measurements (mm). Head width 3.2, head length 2.7, wing length 7.5, total length 12.

Head. About 1.2 times broader than long; eyes moderately convergent below, upper interorbital distance about 1.2 times lower; malar space linear, without posterior pit. Transverse basal ridge of labrum low, broadly interrupted in middle. Apical margin of clypeus not thickened. Supraclypeal area flat, about 1.4 times broader than long. Clypeus polished between subcontiguous to dense punctures; supraclypeal area broadly impunctate and polished in middle, elsewhere subcontiguously punctate, interspaces polished. Interocellar distance slightly less than ocelloccipital distance or ocellocular distance. First flagellar segment shorter than pedicel or second flagellar segment; median flagellar segments distinctly broader than long.

Thorax. Anterior half of mesoscutal dorsum sharply scabrous; posterior half of mesoscutum and all of scutellum rugosopunctate.

Color. Blackish brown; legs medium brown; tegula and underside of flagellum ferruginous.

Pilosity. Mostly whitish; reddish hairs along apical margin of clypeus, lower margin of mandible, and inner side of basitarsi; first five gastric terga with distinct fasciae of dense, appressed white hairs; posterior margin of pronotum with fascia of white, plumose hairs; discs of terga two through four with sparse, very short, fuscous hairs; fifth segment with conspicuously longer, denser dark hairs; apical segment densely covered with long, dark brown hairs; scopa whitish; all sterna, except last, with conspicuous apical fascia of dense, appressed, white hairs, last segment with brown hairs.

MALE. Measurements (mm). Head width 2.5 to 3.2, head length 2.0 to 2.6, wing length 5.7 to 7.5, total length 8.3 to 10.5.

Head. Head 1.2 to 1.3 times broader than long; eyes moderately convergent below, upper interorbital distance about 1.2 times lower interorbital distance. Labrum with subbasal, median, erect tubercle and with an obsolete ridge extending from base of tubercle to each basal corner. Supraclypeal area flat, about 1.4 times broader than long. Clypeus weakly shiny between continguous to subcontiguous punctures. Supraclypeal area polished and nearly impunctate in middle, with subcontiguous punctures laterad that are coarser than those of clypeus. Interocellar distance a little greater than either ocelloccipital distance or ocellocular distance. First flagellar segment about as long as pedicel, a little shorter than second flagellar segment.

Thorax. Mesoscutum and scutellum with distinct, contiguous punctures.

Color. As described for female.

Pilosity. Similar to that of female, but hairs at apex of clypeus whitish, dark hairs of discs of gastric terga longer; fasciae of second and third terga interrupted in middle; apical fasciae of sterna longer than in female; apical sternite with pale hairs.

TYPE MATERIAL

All type material is from San Bernardino County, California. Holotype female: Cedar Canyon, 4650 ft. elev. (Sec. 36, T13N, R14E), 18 June 1980 (T. Griswold), on *Eriogonum fasciculatum* ssp. *polifolium.* Allotype: same locality, 13 June 1980 (T. Griswold). Paratypes: 2 ♀♀, 5 ♂♂, same locality, 18 and 30 June 1980 (T. Griswold); 1 ♀, Fenner Valley, 3670 ft. elev. (Sec. 29, T11N, R15E), 17 June 1980 (T. Griswold), on *Chilopsis linearis*; 1 ♂, Colton Hills, 3500 ft. elev. (Sec. 12, T10N, R14E), 17 June 1980 (T. Griswold), on *Ferocactus acanthodes*; 1 ♀, 7 ♂♂, Wild Horse Canyon, 4300 ft. elev. (Sec. 18, T11N, R15E), 6 June 1980 (T. Griswold), on *Opuntia echinocarpa*; 1 ♂, same locality, 27 May 1980 (T. Griswold); 1 ♀, Van Winkle Mts., 10 June 1965 (G. E. Wallace); 11 ♂♂, 9.5 mi. NNE of Cima, 4200–4265 ft. elev. (Morningstar Mine Road), 1–4 June 1977 (R. R. Snelling and C. D. George), on *Encelia californica*; 1 ♂, 10 mi. NE of Earp, 31 March 1959 (A. S. Menke and L. A. Stange). Holotype and allotype in LACM; paratypes in LACM, UCR, and GRIS.

ADDITIONAL SPECIMENS

CALIFORNIA, *Riverside Co.:* 1 ♀, 30 May 1963, on *Opuntia ramosissima*; 2 ♂♂, 3 May 1963, on *Echinocactus* sp.; 1 ♂, 26

April 1963, on *Cereus* sp.; all from Deep Canyon (E. I. Schlinger; UCR).

ETYMOLOGY

From Greek, *listrotos* (leveled), in reference to the flat supraclypeal area of both sexes.

BIONOMICS

Little is known of this species. Floral records within the Cactaceae include the genera *Cereus, Echinocactus, Ferocactus,* and *Opuntia* but are so few that no clear preference can be established. The few females available all bear pollen from Cactaceae. Noncactus floral visits are known for both sexes and are presumed nectar sources.

In the Mojave Desert, from which most specimens were collected, the elevational range is from 3500 to 4650 feet (approximately 1067 to 1417 meters). Many specimens do not bear elevation data, but most, if not all, seem to fall within this range. Most specimens have been collected in June, but the earliest record is 31 March. Within the Mojave Desert, captures range between 27 May and 30 June. Earlier records are all from the margins of the Colorado Desert (Deep Canyon and 10 miles northeast of Earp).

DISCUSSION

Both sexes of *L. listrota* may be readily separated from all known species of *Lithurgopsis* by the flattened supraclypeal area with a shiny, impunctate median line. Since the females of other species all possess some conspicuous modification of the supraclypeal area, the lack of such in the case of the *L. listrota* female is especially obvious.

Males of *L. listrota* differ less conspicuously from those of the other species, since males of none have prominent elevations on the supraclypeal area. But, in these other species, the supraclypeal area is weakly depressed along the midline and weakly elevated toward the subantennal suture on either side. This contour is particularly evident in such species as *L. apicalis.* Only in *L. listrota* and *L. planifrons* is the supraclypeal area completely flat, even though it is slightly elevated above the adjacent areas of the face; males of *L. planifrons* have the median line coarsely and contiguously punctate and lack an erect labral tubercle.

Of the known North American species, only one, *L. apicalis,* is sympatric with *L. listrota.* Males of *L. apicalis* tend to be larger than those of *L. listrota* and possess a relatively strongly elevated supraclypeal area. In addition, the labrum does not bear a median tubercle but has instead a low subbasal ridge.

It is possible that the ranges of *L. listrota* and *L. echinocacti* may overlap in southern California or in Baja California. The male of *L. echinocacti* lacks a median tubercle on the labrum, and the legs are often ferruginous.

Geographically, the nearest species with a labral tubercle is *L. socorroensis* in southern Arizona. In this species, there is a distinct ridge extending laterad from the median tubercle to the margin of the labrum near midlength. In *L. listrota* males, the ridge extends obliquely to the anterolateral corner of the labrum. In addition, the clypeus of *L. socorroensis* males is coarsely punctate, with the punctures discrete, especially in the middle. In contrast, the clypeus of *L. listrota* is finely and contiguously punctate in most areas, with the punctures often distorted.

Lithurge (*Lithurgopsis*) *littoralis* (Cockerell)

Figures 3, 4

Lithurgus apicalis littoralis Cockerell, 1917:191. ♂.

Lithurgus bruesi Mitchell, 1927:104. ♂. NEW SYNONYMY.

RANGE

Illinois to New Mexico, south to the State of Oaxaca, México.

BIONOMICS

Parks (1930) observed the behavior of this bee (as *L. bruesi*) in Texas. He noted that females visited *Opuntia lindheimeri, O. ellisiana,* and *Echinocactus setispinosus* for pollen. Nectar sources for both sexes included *Monarda punctata, M. citriodora,* and *Vitex negundo incisa.* Previously unpublished floral records include *Acacia* sp., *Callirhoe involucrata, Colubrina texensis, Opuntia macrorhiza,* and "composite."

DISCUSSION

The type of *L. littoralis,* from Port Isabel, Texas, is in the British Museum (Natural History) and was made available by G. R. Else. This type has been compared with specimens of *L. bruesi*; there is no doubt that the two are conspecific. Mitchell (1938) first suggested that this might be the case but had not seen the type of *L. littoralis.*

TYPE MATERIAL

Lithurgus apicalis littoralis Cockerell: male, in British Museum (Natural History). *Lithurgus bruesi* Mitchell: male, in Museum of Comparative Zoology.

SPECIMENS EXAMINED (86 ♀♀, 87 ♂♂)

UNITED STATES. ILLINOIS, *Jersey Co.:* Principia College, Elsah (UKAN). KANSAS, *Bourbon Co.:* Fort Scott (UKAN). *Johnson Co.:* Olathe (UKAN). NEW MEXICO, *Lincoln Co.:* Nogal (UKAN). OKLAHOMA, *Cimarron Co.:* 14–18 mi. N of Boise City (UTSU). TEXAS, *Aransas Co.:* 10 mi. N of Rockport (UKAN, UNEB). *Bexar Co.:* (AMNH, LACM, TAMU, UKAN, UTSU); San Antonio (TAMU); Ft. Sam Houston (UCB). *Brewster Co.:* Big Bend Natl. Park (The Basin; Window Trail; AMNH, TAMU, UCB, UKAN); 12 mi. NW of Alpine (UKAN). *Cameron Co.:* 18 mi. N of Harlingen (UKAN); McAllen (AMNH); Port Isabel (BMNH). *Duval Co.:* 8 mi. W of Fremont (TAI). *Goliad Co.:* (TAMU). *Hidalgo Co.:* Edinburg (AMNH). *Howard Co.:* Big Spring (USNM). *Jeff Davis Co.:* Davis Mts. (AMNH, UKAN). *Jim Wells Co.:* (TAMU). *Kenedy Co.:* 3 mi. S of Sarita (TAI).

Kerr Co.: Kerrville (UKAN). *Kleberg Co.:* Kingsville and vicinity (TAI, UKAN); Bishop (UKAN). *La Salle Co.:* Cotulla (USNM). *Maverick Co.:* Quemado (UKAN). *Presidio Co.:* 10 mi. SE of Presidio (TAMU). *San Patricio Co.:* (UKAN). *Sutton Co.:* Sonora (UKAN); 45 mi. S of Sonora (UKAN). *Tom Green Co.:* (UKAN). *Travis Co.:* Austin (TAMU). *Uvalde Co.:* Garner State Park (TAMU); Sabinal (USNM); Uvalde (UKAN, UNEB). *Val Verde Co.:* Del Rio (AMNH); 19 mi. S of Langtry (LACM). *Victoria Co.:* Victoria (USNM). *Webb Co.:* 22 mi. S of Laredo (UKAN). *Zavalla Co.:* Nueces River (USNM). *County unknown:* "Lopeno" (UKAN). *MÉXICO.* COAHUILA: 15 mi. N of Saltillo (AMNH). HIDALGO: Pachuca (UTSU). NUEVO LEÓN: 4 mi. W of El Cercado (UCB, UKAN). OAXACA: Matatlán (UCB). PUEBLA: 10.5 mi. E of Azumbilla (TAMU).

Lithurge (*Lithurgopsis*) *planifrons* (Friese)

Lithurgus planifrons Friese, 1908:62. ♂.

RANGE

Central México.

DISCUSSION

No authentic material of *L. planifrons* has been available for study; the species is based on a unique male, and the original description is broad enough that it can be applied to almost any North American *Lithurge* male. Were it not for the descriptive specific epithet chosen by Friese, this would remain a species of questionable identity.

Three males from Chamela, Jalisco, México, collected by S. H. Bullock, are, I believe, representatives of this species. More important than that they agree with the original description is that the face is flat. The supraclypeal area is not at all elevated above the level of the clypeus and does not, in its upper portion, slope toward the antennal sockets. The only other species with a flat supraclypeal area is *L. listrota*; males of *L. listrota* possess a prominent erect tubercle on the labrum, lacking in *L. planifrons.* In addition, males of *L. listrota* have a conspicuous median impunctate line on the supraclypeal area.

Since the male of *L. planifrons* lacks an erect labral tubercle, it resembles males of both *L. apicalis* and *L. echinocacti.* From both of these species, *L. planifrons* is separable by the flat supraclypeal area, which does not have a median impunctate line. Instead, the supraclypeal area is conspicuously more coarsely punctate in the middle than on either side; these coarse punctures are subcontiguous, and a similar central line of coarse punctures is present on the clypeus. The supraclypeal area of *L. apicalis* and *L. echinocacti* is distinctly convex between the clypeal base and the antennal sockets (often depressed in the center in *L. apicalis*), and the middle is distinctly shiny and impunctate (sometimes the entire supraclypeal area sparsely punctate in *L. apicalis*).

The type locality for *L. planifrons* was originally cited as "Jacubaya, Mexico." This is a misprint for Tacabaya, now a suburb of Mexico City.

Lithurge (*Lithurgopsis*) *socorroensis* (Mitchell)

Figures 7, 8

Lithurgus socorroensis Mitchell, 1938:152–154. ♀ ♂.

RANGE

Southern Arizona to Costa Rica; Revillagigedo Archipelago.

BIONOMICS

Little is known of this species, not previously recorded from the mainland. Both sexes have been taken at flowers of *Opuntia* sp. on Socorro Island, the type locality. Males were taken in Arizona on "thistle." In Costa Rica, both sexes have been collected on *Opuntia* sp. and males were on *Cydista heterophylla, Paullinia costaricensis, Pterocarpus rohrii, Securidaca sylvestris,* and "pink bignon vine."

DISCUSSION

Females of this species are similar to those of *L. echinocacti* in the structure of the supraclypeal area. In *L. socorroensis,* the legs are brown, rather than red, and there is no pubescent fascia on the dorsal margin of the pronotum. The male can be recognized by the structure of the labrum, as noted in the key.

TYPE MATERIAL

Lithurgus socorroensis Mitchell: female holotype and allotype in California Academy of Sciences.

SPECIMENS EXAMINED (18 ♀♀, 24 ♂♂)

UNITED STATES. ARIZONA, *Pima Co.:* Santa Catalina Mts. (UNAR); Rincon Mts. (Madrona Ranger Station; UNAR); Baboquivari Mts. (UCR); Continental (UTSU). *MÉXICO.* JALISCO: Guadalajara (UTSU). MORELOS: Cuernavaca (UKAN). PUEBLA: Petlalcingo and vicinity (UCD, UTSU). ISLAS REVILLAGIGEDO: Socorro Island (CAS, LACM, UTSU). SINALOA: 50 mi. NW of Mazatlán (UTSU). VERA CRUZ: 8 mi. SW of Vera Cruz (UTSU). *EL SALVADOR.* LA LIBERTAD: 5 km. NW of Quezaltepec (Hacienda Capolinas; UCR). *COSTA RICA.* GUANACASTE: Hacienda Comelco (LACM, UCB).

Lithurge (*Lithurge*) *chrysurus* (Fonscolombe)

Lithurgus chrysurus Fonscolombe, 1834:220. ♀ ♂.

RANGE

Countries bordering western Mediterranean Sea; adventive in eastern United States.

BIONOMICS

According to Roberts (1978), females construct communal nests in both soft and hard woods, causing serious damage.

Cells are usually separated by wood-dust partitions and are packed with a pollen and nectar mass gathered from *Centaurea maculosa* (Compositae), an introduced weedy plant. When partitions are absent, two or three regularly spaced larvae feed on the single large pollen mass. When larval feeding is completed, the mature larva defecates and spins a pupal cocoon. Immatures overwinter as prepupae, and pupation oeeurs during the following spring.

DISCUSSION

Friese (1911) gives a complete synonymy for *L. chrysurus.* Roberts (1978) reported this Palaearctic species from New Jersey, where it had been established for at least three years; nesting biology, behavior, and immature morphology were all deseribed by Roberts. In North America, this bee is presently known only in New Jersey, where it is oligolectic on *Centaurea maculosa,* a plant also native to countries bordering the western Mediterranean Sea.

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I am especially grateful to G. R. Else for his assistance in locating, and making available, the type of *L. apicalis littoralis.*

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